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ABSTRACT

This report evaluating the Kansas Reflection-Impulsivity Scale for Preschoolers (KRISP), developed as an easier task version of the Matching Familiar Figures Test for school-age children, presents an analysis of data on 1,408 children of widely varying backgrounds. Eighteen samples of children, ranging in age from 2 years and 5 months to 6 years and 8 months, were studied by investigators in the United States, England and Australia. The KRISP consists of 5 practice items and 10 test items on each of 2 forms. Each item presents a standard line drawing of a common object together with 4 to 6 similar alternatives, only one of which is an exact duplicate of the standard figure. The child is asked to indicate the duplicate, and latency to first response and number of errors are recorded. For purposes of normative analysis, subjects were grouped according to four age intervals. Results are presented on age, sex and other effects, on test-retest reliability, inter-form agreement, validity, normative analysis, sample differences and demographic characteristics related to cognitive style. The report concludes with a discussion of results, examining the speed-accuracy trade-off and choice of strategy, and cognitive development and practice-familiarity. Although the KRISP is seen as a useful research tool, its use for clinical or educational diagnostic purposes with individual children is not recommended in the absence of additional evidence of validity. (BF)

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The KRISP: A Normative Evaluation

John C. Wright
with the assistance of:
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and
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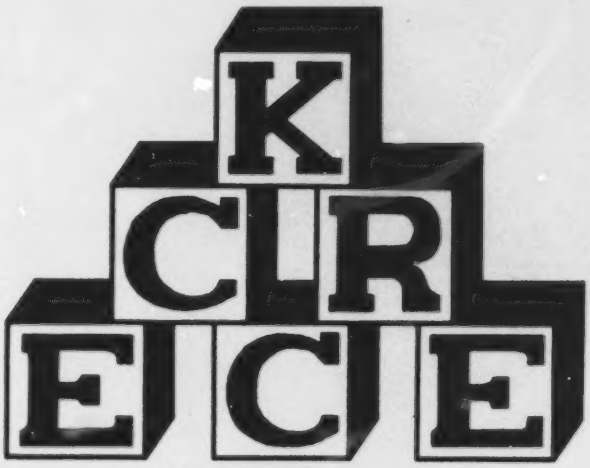

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1978

This is the final report for Componenet II, Attention and Cognitive Styles, under contract number NE-C-00-3-0104 which was terminated at the end of May, 1975.

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Introduction

Background

About 15 years ago, Kagan, et al., (1964) developed the notion of reflection-impulsivity as a dimension of cognitive style which they termed conceptual tempo. As the concept has developed since that time, it has been shown to be associated with a wide variety of individual differences in perception, attention, strategies of information processing, learning, motor impulse control, visual scanning and analysis, reading, other cognitive styles, and a variety of personality characteristics and social behaviors. For a recent review of the literature on reflection-impulsivity, the reader should see Messer (1976).

The measurement of relection-impulsivity in school-age children is ordinarily accomplished by use of the Matching Familiar Figures Test (Kagan,et al., 1964), a match to sample task consisting of a standard ink drawing of a figure (e.g., tree, house, boat, telephone), accompanied by an array of six very similar drawings, one of which is an exact copy of the standard, and the other five of which each differ from the standard in a single, unique, and identifiable detail. There are two practice items and twelve test items in the standard MFF test. Although the MFF has been sharply criticized by a number of investigators (Block, Block & Harrington, 1974), and defended by others (Kagan and Messer, 1974), it has been used in a large number of studies, most of which have found group differences between reflective and impulsive children. Impulsive children are conventionally defined as those scoring below the sample median in mean latency to first response and above the sample median in total errors. Conversely, relectives are defined as those scoring above the sample median in latency and below it in errors. Because impulsives are fast, but inaccurate and reflectives are slow, but accurate, it is not surprising that on

most other tasks requiring more accuracy than speed, reflectives have consistently outperformed the impulsives. Even on non-verbal scales of intelligence, the reflectives perform better, but the two style groups do not regularly differ in verbal intelligence.

Because latency and errors on the MFF are negatively correlated (about -.40 to -.70 in school-age populations), about 35% of each sample on the MFF has fallen in the reflective quadrant and another 35% in the impulsive quadrant, defined by median splits. The remaining 30% of the subjects in most studies have been about equally divided between the fast-accurate and the slow-inaccurate quadrants, and have been excluded from further study. These neglected groups obviously differ more in efficiency of performance (speed cum accuracy) more than they do in strategy (speed vs. accuracy), and that difference in efficiency (which is related to verbal IQ) has not been of as much interest as the difference in strategy between the reflectives and impulsives in this body of research. Recently Salkind and Wright (1977) have proposed a method by which a single impulsivity score (and a single efficiency score) can be derived from MFF latency and error raw scores, yielding a continuous scale distribution of all subjects in a sample from the most reflective to the most impulsive. Moreover, national large-N norms are now available for the MFF (Salkind, 1978a), so that two of the major problems in the assessment of reflection-impulsivity appear to be solved: scaling of the key variable for all subjects and population norms to replace sample-generated norms.

Although individual stability of characteristic test scores from the preschool to school-age years has been relatively low for almost all types of assessment, the volume of research on reflection-impulsivity in school-age children inevitably led to the question of earlier origins of cognitive style

differences. The reader is referred to Kogan (1977) for a recent and thorough review of research on cognitive styles in younger children.

The KRISP

The Kansas Reflection-Impulsivity Scale for Preschoolers (Wright, 1971) has been developed as an easier task modeled on the MFF, and designed for younger children. It consists of five practice and ten test items on each of two forms (A and B). Each item presents a standard line drawing of a common object, together with four to six similar alternatives, only one of which is an exact copy duplicate of the standard figure. The child is asked to find and point to the one exact copy in the array, and as is done with the MFF, latency to first response and number of errors are recorded. A sample KRISP item is shown in Figure 1.

Figure 1 about here

Standard instructions are used, and they go beyond those used on the MFF to include standard prompts to be used when the younger children forget or fail to follow the instructions. Where the MFF instructions permit up to five errors per item, on the KRISP children are advanced to the next item after a third pointing error on any item. As with the MFF, mean latencies to first response (regardless of its accuracy) and total errors (maximum = 30 in ten items) are recorded. The KRISP and a preliminary User's Manual (Wright, 1973 a) are published by CEMREL, Inc., (3120 59th Street, St. Louis, Missouri, 63139). A previous technical report on the KRISP (Wright, 1973 b) is available from the author.

METHOD

The Samples

The present report presents an analysis of KRISP data on children from 18 samples, studied by a variety of investigators in the U.S., England, and Australia. Where the 1973 technical report included data from only 307 children tested in Kansas, the present samples include 1,408 cases drawn from widely varying geographical, ethnic, residential, and socioeconomical sources. Included are 722 females and 686 males, ranging in age from 2 years, 5 months to 6 years, 8 months. The bulk of the children were between 3 years, 6 months and 5 years, 6 months in age. All of the children included in the subsequent analyses were tested on Form A (765) or Form B (643) by a trained, individual examiner, using the standard KRISP instructions and procedures, between 1971 and 1975. Some of the subjects were subsequently retested with the alternate form (see form comparability and test-retest reliability, below). For purposes of normative analysis children were grouped into four intervals by age: Age Code 1 = 2:5 to 3:6; Age Code 2 = 3:7 to 4:6; Age Code 3 = 4:7 to 5:6; and Age Code 4 = 5:7 to 6:8. Table 1 summarizes the population studied by age and sex.

Table 1 about here

The 18 samples from which the present data are derived are summarized in Table 2. Four additional samples have been entirely eliminated because suffi-

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Table 2 about here

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ciently descriptive information regarding source and SES composition was not

available. Some 385 cases are not included in the base analysis of 1,408, either because they came from a sample that was eliminated, or because there were administration and/or scoring anomalies or missing age or sex identification.

Observer Reliability

Although most of the investigators reporting data for the present analysis did not report systematic assessment of observer or scorer reliability, all reported that they trained examiners to a criterion of 100% agreement on recording of errors. Standard definitions for scoring latency were used by all, and the criterion expected for the KRISP is set at 90% agreement within a half-second between two independent observers. For the seven samples collected by our own staff, dual scoring was performed on 97 of the 715 cases by two simultaneous, independent observers. On 96.1% of the 970 items dually scored they agreed within 0.5 sec. for latency of response. On 99.4% of the items they agreed exactly on the number of errors.

RESULTS

Test-retest Reliability

There were a total of 495 cases of children who were tested twice on the KRISP, the interval between testings ranging from one to eight weeks. Any subject whose age code changed between testings was eliminated from this analysis. Overall from the first testing to the second, there was a significant increase in latency ($F\ 1, 487 = 9.52$; $p < .002$) and a significant decrease in errors ($F\ 1, 487 = 71.91$; $p < .001$). No interactions involving test vs. retest were significant, except the interaction between age and testing for errors ($F\ 3, 487 = 6.48$; $p < .001$). This interaction means that the practice effect for errors was greatest for the youngest subjects and least for the oldest. Figure 2 shows the

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Fig. 2 about here

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practice effects for latency and errors as a function of age and sex, graphed on a latency-by-errors plot.

Correlations between session one and session two (test vs. retest) data on errors and latency were calculated by age and sex, and are reported in Table 3. Overall the test-retest reliability was .581 for latencies and .746

Table 3 about here

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for errors. It should be noted of the 495 cases included in this analysis, 449 of them were retested with a different form of the KRISP on their second administration than had been used on their first administration. Thus one would expect the reliabilities to be higher than these had the same form been used twice in all cases. None of the twice-tested subjects were in studies where any experimental treatment or training intervened between first and second testing, unless they came from the untreated control group of such a study. Significance levels are not reported because all correlations larger than about .10 are highly significant, and any smaller than that are of little importance.

Inter-form Agreement

Of the 495 cases tested twice on the KRISP, 449 received a different form on the retest than had been given on the initial test. Of these, 261 were given the forms in the order, A then B, and the remaining 238 were tested with Form B first, followed by Form A. The test-retest analysis above compared first with second testing regardless of form or change of form. The next analysis is con-

cerned with comparison of Form A with Form B, regardless of the order in which they were administered.

Overall there were no significant main effects of form or interactions involving form on latency or errors. The nonsignificant differences whereby Form B yielded slightly longer latencies and slightly fewer errors may be attributed to the fact that there is a significant practice effect (see above) which influences the form comparison because a few more subjects (23) got Form B second than got it first. But with this many degrees of freedom, such nonsignificant effects may be disregarded with considerable confidence.

Using the same 449 cases, interform correlations were calculated for latencies and errors by age and sex. These correlations appear in Table 4.

Table 4 about here

Overall it can be seen that the agreement between forms is good for errors (.718) and fair for latencies (.586).

Validity

There is no single, conclusive way of evaluating the validity of the KRISP. Because the MFF is designed for older children, the only subjects on whom it would be appropriate to compare the two tests would be five- to seven-year-olds. One study has made this comparison (Schlecter and Salkind, 1977) and found significant inter-test correlations for errors and latency that are fairly respectable given the limited test-retest reliability of the KRISP and the MFF.

A second validity indicator is the relationship between KRISP scores and other variables such as attention spans in free play, distractability in the preschool environment, motor impulse control, and a variety of teacher ratings,

as has been reported by McClanahan (1975). Again the results are only moderately positive. Stronger positive results were shown in a study by McCluskey and Wright (1975) of visual scanning behavior of KRISP-designated reflective and impulsive preschoolers: The reflectives were more systematic scanners; made more homologous comparisons between stimuli; and visually fixed more information (as opposed to spatially salient) portions of stimuli than did the impulsives. Wright (1974) found reflectives ahead of impulsives in the development of visual strategies. Siegel et al., (1973) found differences in memory for visual detail between KRISP-designated reflectives and impulsives. Sussman, Huston-Stein, and Friedrich-Cofer (1977) found KRISP-designated reflectives higher than impulsives in both aggressive and prosocial behavior.

A third indicator of the validity of the KRISP is concerned with the degree to which children working on it display a tendency to choose between speed and accuracy as a matter of strategic choice. Since reflection-impulsivity is conceptualized as being in part a matter of preference, the degree to which children manifest a trade-off between speed and accuracy can serve as an indicator of the degree to which a set to choose between them has been established in the testing situation. One numerical indicator of this strategic trade-off is the magnitude of the negative correlation between speed and accuracy. On the MFF with school age youngsters, the correlation between latency and errors is of the order of -.60 or thereabouts. All reported latency-by-errors correlations for preschoolers have been smaller than that (Kogan, 1977). Table 5 presents the correlations

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Table 5 about here

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between latency and errors for the first administration of the KRISP based on

all 1,408 cases. While of course highly significant, the correlations are small, averaging - .23 overall. Tables 6 and 7 report the first and second administrations

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Tables 6 and 7 about here

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and the Form A and Form B correlations between latency and errors separately by age and sex based on 495 and 449 cases, respectively. The correlations appear to become larger with retesting for younger subjects, but smaller with older subjects. The latter is probably due to a floor effect with older subjects approaching zero errors, thus causing restricted variance and attenuated correlation. In general the correlations are larger for males than for females, and larger for Form A then for Form B.

Normative Analysis

Table 8 gives the means and standard deviations of latencies obtained for

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Table 8 about here

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first administration of the KRISP to 1,221 children. The 185 urban Headstart children (samples 7, 14, and 15) were excluded from these norms because of their marked discrepancy in latency and errors from the rest of the subjects. In a between-groups analysis of variance of latencies incorporating age (four code levels), sex (2), and form the the KRISP (2), only the main effects of age ($F_{3, 1392} = 4.65$; $p < .003$) and sex ($F_{1, 1392} = 7.31$; $p < .007$) were significant. Males had longer latencies than females, and the 5½ and 6 year olds (Age Code 4) had shorter latencies than the younger children. The F-values for the main

effect of Form and for all the interactions were less than 1.0.

Table 9 shows the means and standard deviations of errors for the same

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Table 9 about here

1,221 children as a function of age, sex, and form of the KRISP. Once again, none of the effects of Form nor any of the interactions approached significance, while the main effects of age and sex were highly significant. Males made more errors than females ($F\ 1, 1392 = 12.08$; $p < .001$), and errors declined as a negatively accelerated function of age ($F\ 3, 1392 = 193.64$; $p < .001$). Figure 3 shows the age and sex differences on a latency-by-errors plot. The age trend for

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Fig. 3 about here

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both sexes resembles that found by Salkind (1978 b) with MFF data on children five years older than these; from relatively impulsive, to relatively reflective, to relatively efficient.

Sample Differences

As a preliminary to the demographic analysis of the different sources from which samples were contributed to these norms, an analysis of the effects of source was made. Because in some cases sample was confounded with age (e.g., sample 02 contained only kindergarten children of Age Code 4), only data from sources providing at least ten cases in Age Codes 2 and 3 were included. Included in this analysis were 809 children from 13 samples. The between-groups analysis of variance was of the form: 2 (age) x 2 (sex) x 13 (samples). Due to the smaller N and the restricted age, the sex effect only approached significance for

latency ($F_{1, 757} = 2.81$; $.05 < p < .10$) and errors ($F_{1, 757} = 3.43$; $.05 < p < .10$); and the age effect was significant for errors ($F_{1, 757} = 36.52$; $p < .001$), but not for latency ($F < 1.0$). Figure 4 shows the distribution of

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Fig. 4 about here

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samples graphed on a latency-by-errors plot. Samples are identified by number in Table 2.

Setting, Community, and Income Level

It has been possible to designate for most of the samples in the norming study three other demographic characteristics that could be related to cognitive style. On the basis of descriptions supplied along with the data, most samples could be identified as coming from children tested in a Headstart, day care, or preschool setting. Although this stratification is of course confounded with other variables, such as income level and parents' education, it could nevertheless be informative to compare these settings on the KRISP scores of the children in them. In this analysis it was necessary to exclude the oldest age-code group because those children would have formed a fourth setting category, kindergarten, that would be completely confounded by age. The analysis of variance of latency and error scores was based on 1160 cases grouped into 3 ages x 2 sexes x 3 settings. The results are given in Tables 10 (latency) and 11 (errors). As

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Tables 10 and 11 about here

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usual, the effects of age and sex were significant, except that the elimination of age group 4 reduced the age effect on latencies to nonsignificance. The effect

of setting was highly significant for both latency (F 2, 1,138 = 36.36; $p < .001$) and errors (F 2, 1,136 = 38.79; $p < .001$). Figure 5 shows the nature of the

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Fig. 5 about here

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settings effect on a latency-by-errors plot. Headstart children were more impulsive than day care children, who were in turn more impulsive than preschool children. But because the latter came mostly from University preschools and the Headstart children came mostly from urban low income communities, interpretation of this finding is not unequivocal. Only one interaction was significant: age-by-setting for both latency (F 4, 1,138 = 3.76; $p < .005$) and errors (F 4, 1,138 = 3.20; $p < .02$). In the Headstart setting, children are impulsive at the youngest age and are more reflective with increasing age. In the preschool setting, however, the youngest are already relatively reflective, and their gains are in efficiency. The day care subjects show an intermediate pattern of age differences.

Next we consider the effects of type of community in which the children live, stratified by estimated population density. From the reports of those supplying data it was possible to classify most samples as coming from communities designated as urban, suburban, town, or rural. In order not to confound this designation with age and to have a reasonable $\underline{N}$ in each cell, it was necessary to eliminate the youngest and the oldest age codes, leaving a total of 954 cases for this analysis. The design was 2 (age) x 2 (sex) x 4 (community types). The results are given in Tables 12 (latency) and 13 (errors). As usual the main effects of

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Tables 12 and 13 about here

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sex and age are significant for both latency and errors. The effect of community was significant for both latency ($F_{3, 934} = 15.64$; $p < .001$) and errors ($F_{3, 934} = 21.19$; $p < .001$). No interactions were significant.

Figure 6 shows the community effect on a latency-by-errors plot. It appears

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Fig. 6 about here

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that both urban and rural children are relatively impulsive; that children from small towns are more reflectively impulsive; that children from small towns are more reflective; and that by comparison those from suburban communities are the most efficient. Again is must be emphasized that these differences are partially confounded with those due to income and parental education, as well as type of setting.

Finally, a third demographic stratification of the samples was attempted on the bases of gross reported differences in typical family income. Three levels were designated: Lower (at or near poverty level), lower-middle (blue-collar), and middle (retail, managerial, technical, academic). The divisions were applied to entire samples and were not assessed for individual children. The judgments of the investigators supplying data were accepted at face value. For this analysis, all 1,408 cases were used in a 4 (age) x 2 (sex) x 4 (income) analysis of variance. The number of cases in the most finely divided cells ranged from 18 to 118. Table 14 (latency) and 15 (errors) indicate the results.

Tables 14 and 15 about here

As before, the main effects of sex and age are significant for both latency and

errors. The effect of income was significant for both latency (F 2, 1,384 = 27.28; $p < .001$) and errors (F 2, 1,384 = 40.33; $p < .001$). The lower income children were both faster and less accurate than the others; while the middle income children were the slowest of all, and slightly more accurate than the lower-middle income children. The income-by-age interaction was significant for both latency (F 6, 1,384 = 12.76; $p < .001$) and errors (F 6, 1,384 = 7.21; $p < .001$). The nature of the interaction is shown in Figure 7 on a latency-by-

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Fig. 7 about here

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errors plot. It appears that lower income children are much more impulsive than the others, but become markedly more reflective with age, without much gain in efficiency. Lower middle income children start out as reflective as the middle income children and remain so, while showing major gains in efficiency (speed with accuracy). Finally, the middle income children appear more conservative than the lower-middle income children, in that starting from the same relatively reflective position, they do not begin to speed up and gain efficiency until they have gotten their error rates very low indeed, and even then (5- to 6-year-olds) do not respond as fast as the lower and lower middle income children.

DISCUSSION

The speed-accuracy trade-off: A choice of strategy?

While the magnitude of the negative correlation between latency and errors serves as an index of the degree to which variance associated with efficiency is minimized and variance associated with emphasis on speed vs. accuracy is maximized, it is not a perfect index of strategic awareness, deliberation, or reasoning. With repect to the generally low order of these speed vs. accuracy

correlations, as compared with those for older children on the MFF, it should be noted that the more efficiency variance there is in a sample, the less will be the variance associated with reflection-impulsivity, and the smaller will be the negative correlation between latency and errors. Since a wide range (one year) is included in each age interval in these analyses and an even wider range (four years) in the overall analyses, it is not surprising that the correlation is smaller than it is with older children, who show less developmental spread within the same age interval (i.e., who are developing more slowly). Moreover, it is likely that the preschooler simply has less comprehension of the options, or the strategic trade-off available that permits a choice between speed and accuracy, than does the school age child. Alternatively, it is likely that the increased time made available by slower performance is not as effectively spent on error-reducing activities (like systematic visual scanning and comparisons) by preschoolers as it is by school age children. At present, it appears that there are too many, rather than too few possible explanations for the lower correlations found among younger children.

What is most interesting about the speed-accuracy trade-off is that the developmental trend for most children is to slow down with increasing age, as if the true requirements for acceptable accuracy were only appreciated among older children, or as if self-imposed accuracy standards were increasing with age. Whether it represents a change in aspiration and standards of quality or a gradual appreciation of how much visual analysis is required for a given level of accuracy, the trend is apparent that latencies do not tend to decline until errors have been reduced to a low level. The most satisfactory conclusion is that with increasing age there is a decline in errors, achieved at first by taking time for visual comparison and analysis. Later, speed can be increased

without a loss of accuracy -- a matter of improving efficiency by practice, not by altering strategy.

Cognitive development and practice/familiarity

It is interesting that Salkind (1978 b) has found the same trend from impulsive to reflective to efficient among large numbers of older children tested with the MFF. Latencies increase from age 5 to age 10 among his American and Israeli children, and then decline again, while errors decrease from age 5 to a low asymptote at age 10, and thereafter remain stable. That this is not entirely a maturational phenomenon is indicated by the fact that for Japanese children, the same phenomenon occurs exactly two years earlier (Salkind, 1978 b). If the present data are indicative of the same basic process, that process would appear to be one that is not tied to a developmental timetable, but which instead is accomplished at many ages for different tasks of varying difficulty. It may well be that the phenomenon of impulsive to reflective shift results from the natural course of the child's growing familiarity with any new task (or with age the growing probability of having encountered a similar task). Familiarization is thus a process whereby a reasonable standard of accuracy can be established and the amount of analysis time required to achieve that standard can be known. Again, past that point further improvements are in efficiency, and instead of reflecting an abandonment of the reflective strategy, they indicate an improved ability to use it.

Within subjects, this familiarity interpretation would predict that on retest a child should show at first an increase in latency and a decrease in errors, rather than a decrease in both, as would be predicted by an efficiency interpretation of practice effects. That is precisely what happened in the present study (Figure 2). The fact that on retest the youngest children showed

an increase in the magnitude of the negative correlation between speed and accuracy (Table 6) indicates an enhanced occurrence of strategic choice as a consequence of familiarization. A study employing multiple retestings at various ages is now in progress in order further to test this strategy-familiarity hypothesis.

How good is the KRISP?

It appears that the KRISP does measure in preschoolers the same things that the MFF measures in older children, and that it does so with a moderate degree of test-retest and alternate-form reliability. The stability of reflective-impulsivity itself over the preschool years is not impressive, as we have found in a previous study of KRISP scores from age 4 to age 5 (Wright, 1973 b). The one-year retest correlations in that study were both zero for 19 males. For 21 females they were .67 for latency and .42 for errors. A longitudinal study of predictability of school age MFF scores from preschool KRISP scores has yet to be done, but given typical stability coefficients over this age period, strong consistency is not to be expected (McCall, Eichorn, & Hogarty, 1977). Conversely an attempt to predict preschool KRISP scores of 100 children from various scale and cluster scores on the Brazelton Neonatal Behavior Assessment Scale given in the first month of life has been mostly unsuccessful (Wright, Shindler, & Sullivan, 1977). In our judgment the KRISP is not very satisfactory as an individual assessment instrument. Its use for clinical or educational diagnostic purposes with individual children is not recommended, until additional evidence of validity is obtained. In the meantime it is a useful research tool.

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Table 1

Distribution of norming population by age and sex.

	Males	Females	Total
Age Code 1 2 yrs., 5 mon. to 3 yrs., 6 mon.	89	118	207
Age Code 2 3 yrs., 7 mon. to 4 yrs., 6 mon.	237	233	470
Age Code 3 4 yrs., 7 mon. to 5 yrs., 6 mon.	231	250	481
Age Code 4 5 yrs., 7 mon. to 6 yrs., 8 mon.	129	121	250
Total	686	722	1,408

Table 2

Distribution of cases by source samples

Sample	Description	Number
01.	University laboratory preschool, middle class, small city, Kansas.	259
02.	Public school kindergarten, urban working class neighborhood, large city, Kansas.	118
03.	Private day care center in middle class suburb of a large city, Kansas.	152
04.	Church-sponsored day care center, working class, small city, Kansas.	48
05.	Rural preschool, Indiana.	39
06.	Headstart center, mostly Chicano, rural, Texas.	128
07.	Urban, inner city, Headstart Centers, racially mixed, Pennsylvania.	128
08.	Urban, working class, university-affiliated preschool, Missouri.	66
09.	Small town, working class, England.	50
10.	Small city, middle class, Australia.	72
11.	Small town day care center, community sponsored, Kansas.	41
12.	Private preschool, working class, small city, Kansas.	37
13.	Urban, university laboratory preschool, middle class, Missouri.	68
14.	Urban, inner city, Headstart, mostly black, Illinois.	28
15.	Urban, inner city, Headstart, mostly black, Pennsylvania.	31
16.	Middle class, day care center, small city, Kansas.	60
17.	Suburban, university-affiliated preschool, Ontario.	22
18.	University laboratory preschool, small city, Iowa.	60
	Total	1,408

Table 3

Test-retest correlations for KRISP latencies and errors by age and sex

	N	Latency	Errors
All subjects	498	.581	.746
Males	241	.550	.780
Females	257	.595	.715
Age Code 1	99	.521	.712
Age Code 2	188	.624	.686
Age Code 3	161	.578	.468
Age Code 4	50	.691	.707

All correlations significant beyond the .001 level.

Table 4

Form A vs. Form B correlations for KRISP latency and errors by age and sex

	N	Latency	Errors
All subjects	449	.586	.718
Males	217	.564	.718
Females	232	.589	.717
Age Code 1	88	.512	.618
Age Code 2	167	.658	.650
Age Code 3	146	.553	.500
Age Code 4	48	.637	.668

All correlations significant beyond the .001 level.

Table 5

Correlations between KRISP latency and errors by age and sex

	N	Correlation
All subjects	1,408	-.228
Males	686	-.294
Females	722	-.168
Age Code 1	207	-.288
Age Code 2	470	-.329
Age Code 3	481	-.282
Age Code 4	250	-.210

All correlations significant beyond the .001 level.

Table 6

Correlations between KRISP latency and errors for twice-tested children by session, age, and sex*

	N	1st Session	2nd Session
All Subjects	498	-.218 (.001)	-.204 (.001)
Males	241	-.289 (.001)	-.252 (.001)
Females	257	-.161 (.005)	-.168 (.005)
Age Code 1	99	-.259 (.01)	-.354 (.001)
Age Code 2	188	-.275 (.001)	-.283 (.001)
Age Code 3	161	-.278 (.001)	-.112 (ns)
Age Code 4	50	-.186 (ns)	-.130 (ns)

*Regardless of Form used.

Significance levels given in parentheses.

Table 7

Correlations between KRISP latency and errors for twice-tested children by form, age, and sex*

	N	Form A	Form B
All Subjects	449	-.290 (.001)	-.161 (.001)
Males	217	-.339 (.001)	-.231 (.001)
Females	232	-.253 (.001)	-.105 (ns)
Age Code 1	88	-.396 (.001)	-.286 (.005)
Age Code 2	167	-.385 (.001)	-.223 (.005)
Age Code 3	146	-.294 (.001)	-.101 (ns)
Age Code 4	48	-.180 (ns)	-.114 (ns)

*Regardless of order of testing.

Significance levels given in parentheses.

Table 8

Latency (sec.) as a function of age, sex, and form for first KRISP administration

	Form A			Form B		
	N	Mean	S.D.	N	Mean	S.D.
Males						
Age code 1	44	4.93	2.15	35	4.87	1.77
Age Code 2	97	5.24	2.34	88	4.95	1.95
Age Code 3	101	5.24	1.89	103	5.07	1.98
Age Code 4	75	4.41	1.66	54	4.47	1.74
Females						
Age Code 1	61	4.70	2.11	45	4.96	2.08
Age Code 2	95	4.59	1.87	83	4.79	2.24
Age Code 3	110	4.53	1.76	109	4.54	2.20
Age Code 4	30	4.38	1.88	41	4.06	1.75

Table 9

Errors as a function of age, sex, and form for first KRISP administration

	Form A			Form B		
	N	Mean	S.D.	N	Mean	S.D.
Males						
Age Code 1	44	11.57	5.47	35	12.40	6.17
Age Code 2	97	7.33	4.96	88	6.83	4.33
Age Code 3	101	4.03	3.61	103	4.43	4.11
Age Code 4	75	3.24	2.84	54	3.00	2.35
Females						
Age Code 1	61	10.25	5.66	45	11.56	5.29
Age Code 2	95	6.27	4.45	83	5.67	4.20
Age Code 3	110	3.63	2.66	109	3.48	3.51
Age Code 4	80	2.53	1.73	41	2.59	2.22

Table 10

KRISP latency by age, sex, and setting where children were tested

	Males			Females			Combined	
	Mean	S.D.	N	Mean	S.D.	N	Mean	N
Head Start								
Age Code 1	3.72	1.68	13	2.58	1.41	12	3.15	25
Age Code 2	3.92	1.62	52	3.85	1.41	54	3.89	106
Age Code 3	4.25	1.82	26	3.60	1.39	31	3.93	57
Combined HS	3.96	----	91	3.34	----	97	3.66	188
Day Care								
Age Code 1	4.87	1.91	42	4.75	2.20	55	4.81	97
Age Code 2	4.85	1.59	91	5.08	1.64	85	4.97	176
Age Code 3	4.80	1.77	123	4.31	1.80	147	4.56	270
Combined DC	4.84	----	256	4.71	----	287	4.78	543
Preschool								
Age Code 1	4.95	2.07	37	4.87	1.98	51	4.91	88
Age Code 2	5.93	2.32	94	5.16	2.26	94	5.55	188
Age Code 3	5.69	2.05	81	5.01	2.26	72	5.35	153
Combined PS	5.52	----	212	5.01	----	217	5.27	429

Table 11

KRISP errors by age, sex, and setting where children were tested

	Males			Females			Combined	
	Mean	S.D.	N	Mean	S.D.	N	Mean	N
Head Start								
Age Code 1	15.56	4.72	13	15.42	3.96	12	15.49	25
Age Code 2	9.83	5.96	52	9.70	5.47	54	9.77	106
Age Code 3	6.65	5.34	26	9.19	5.03	31	7.92	57
Combined HS	10.68	----	91	11.44	----	97	11.06	188
Day Care								
Age Code 1	11.21	5.36	42	11.35	5.65	55	11.28	97
Age Code 2	8.40	4.78	91	6.81	4.04	85	7.61	176
Age Code 3	4.33	3.84	123	3.61	2.65	147	3.97	270
Combined DC	7.98	----	256	7.26	----	287	7.62	543
Preschool								
Age Code 1	12.76	6.18	37	10.22	5.37	51	11.49	88
Age Code 2	5.83	4.21	94	5.23	4.45	94	5.53	188
Age Code 3	4.09	3.91	81	3.44	3.90	72	3.77	153
Combined PS	7.56	----	212	6.30	----	217	6.93	429

Table 12

KRISP latency by age, sex, and type of community sampled

	Males			Females			Combined	
	Mean	S.D.	N	Mean	S.D.	N	Mean	N
Urban								
Age Code 2	4.12	1.66	66	4.19	2.06	69	4.16	135
Age Code 3	4.64	2.12	68	4.05	1.76	79	4.35	147
Combined U	4.38	----	134	4.12	----	148	4.25	282
Town								
Age Code 2	5.57	2.23	120	4.90	1.88	119	5.24	239
Age Code 3	5.33	1.90	114	4.76	2.14	117	5.05	231
Combined T	5.45	----	234	4.83	----	236	5.15	470
Suburban								
Age Code 2	4.32	1.36	27	3.83	1.52	22	4.08	49
Age Code 3	5.00	1.53	34	4.08	1.40	38	4.54	72
Combined S	4.66	----	61	3.96	----	60	4.31	121
Rural								
Age Code 2	3.78	2.08	24	4.00	1.93	23	3.89	47
Age Code 3	4.88	2.01	14	4.63	2.09	16	4.76	30
Combined R	4.33	----	38	4.32	----	39	4.33	77

Table 13

KRISP errors by age, sex, and type of community sampled

	Males			Females			Combined	
	Mean	S.D.	N	Mean	S.D.	N	Mean	N
Urban								
Age Code 2	8.88	5.98	66	8.70	5.38	69	8.79	135
Age Code 3	5.62	5.41	68	5.54	4.84	79	5.58	147
Combined U	7.25	----	134	7.12	----	148	7.19	282
Town								
Age Code 2	6.86	4.33	120	5.80	4.59	119	6.24	239
Age Code 3	4.20	3.31	114	3.71	3.46	117	3.96	231
Combined T	5.53	----	234	4.76	----	236	5.10	470
Suburban								
Age Code 2	5.56	3.02	27	6.00	3.92	22	5.78	49
Age Code 3	2.41	1.44	34	3.11	2.14	38	2.76	72
Combined HS	3.99	----	61	4.56	----	60	4.27	121
Rural								
Age Code 2	11.00	5.75	24	7.52	3.78	23	9.26	47
Age Code 3	6.64	4.81	14	4.56	2.87	16	5.60	30
Combined R	8.82	----	38	6.04	----	39	7.43	77

Table 14

KRISP Latency by Age, Sex, and Estimated Income Group

	Males			Females			Combined	
	Mean	S.D.	N	Mean	S.D.	N	Mean	N
Lower								
Age Code 1	3.56	1.46	18	3.33	2.15	29	3.45	47
Age Code 2	3.88	1.77	76	3.90	1.57	77	3.89	153
Age Code 3	4.47	1.89	40	3.95	1.71	47	4.21	87
Age Code 4	4.16	0.93	17	4.61	2.04	27	4.39	44
Combined L	4.02	----	151	3.95	----	180	3.99	331
Lower-Middle								
Age Code 1	5.16	1.83	30	4.89	1.77	36	5.03	66
Age Code 2	4.65	1.60	60	4.70	2.00	65	4.68	125
Age Code 3	4.89	1.86	99	4.29	1.77	118	4.59	217
Age Code 4	4.25	1.69	86	3.99	1.78	74	4.12	160
Combined LM	4.74	----	275	4.47	----	293	4.61	568
Middle								
Age Code 1	5.06	2.10	40	5.05	2.12	53	5.06	93
Age Code 2	5.68	2.28	101	4.87	2.08	91	5.28	192
Age Code 3	5.47	1.97	91	4.88	2.21	85	5.18	176
Age Code 4	5.24	1.86	26	4.83	1.61	20	5.04	46
Combined M	5.36	----	258	4.91	----	249	5.14	507

Table 15

KRISP Errors by Age, Sex, and Estimated Income Group

	Males			Females			Combined	
	Mean	S.D.	N	Mean	S.D.	N	Mean	N
Lower								
Age Code 1	15.06	4.39	18	14.38	4.95	29	14.72	47
Age Code 2	10.20	5.88	76	9.05	5.10	77	9.63	153
Age Code 3	6.65	5.10	40	7.62	4.91	47	7.14	87
Age Code 4	3.12	2.71	17	2.70	1.56	27	2.91	44
Combined L	8.76	----	151	8.44	----	180	8.60	331
Lower-Middle								
Age Code 1	10.23	5.49	30	9.31	4.99	36	9.77	66
Age Code 2	8.18	4.35	60	6.69	4.19	65	7.44	125
Age Code 3	4.94	4.33	99	3.51	2.82	118	4.23	217
Age Code 4	3.05	2.20	86	2.68	1.99	74	2.87	160
Combined LM	6.60	----	275	5.55	----	293	6.08	568
Middle								
Age Code 1	12.63	6.02	40	10.91	5.58	53	11.77	93
Age Code 2	5.51	3.79	101	5.09	4.39	91	5.30	192
Age Code 3	3.09	2.67	91	3.42	3.51	85	3.25	176
Age Code 4	3.46	3.78	26	1.85	1.90	20	2.66	46
Combined M	6.17	----	258	5.32	----	249	5.75	507

Figure 1. Sample KRISP item.

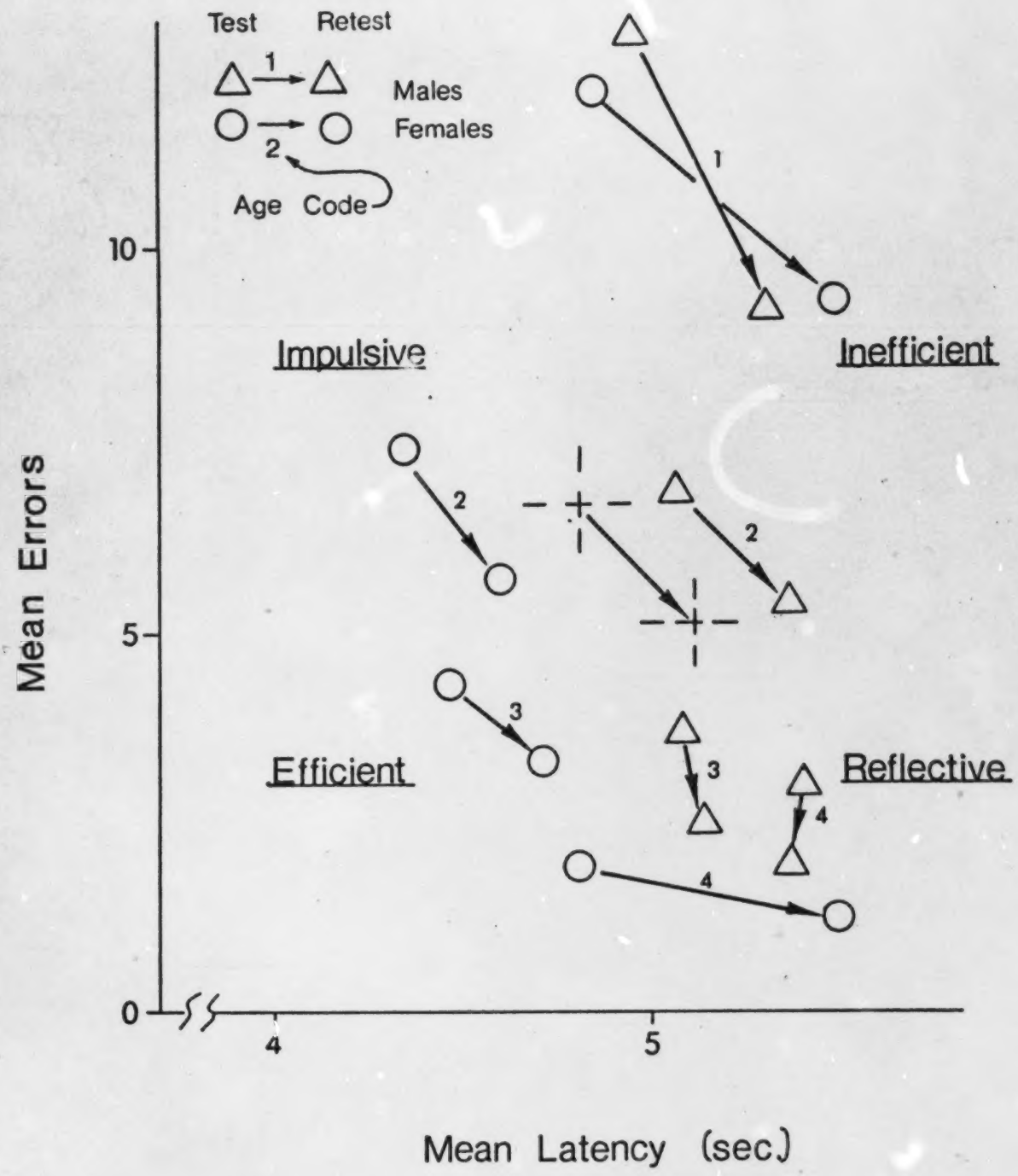

Figure 2. Test - Retest KRISP Performance as a function of age and sex.

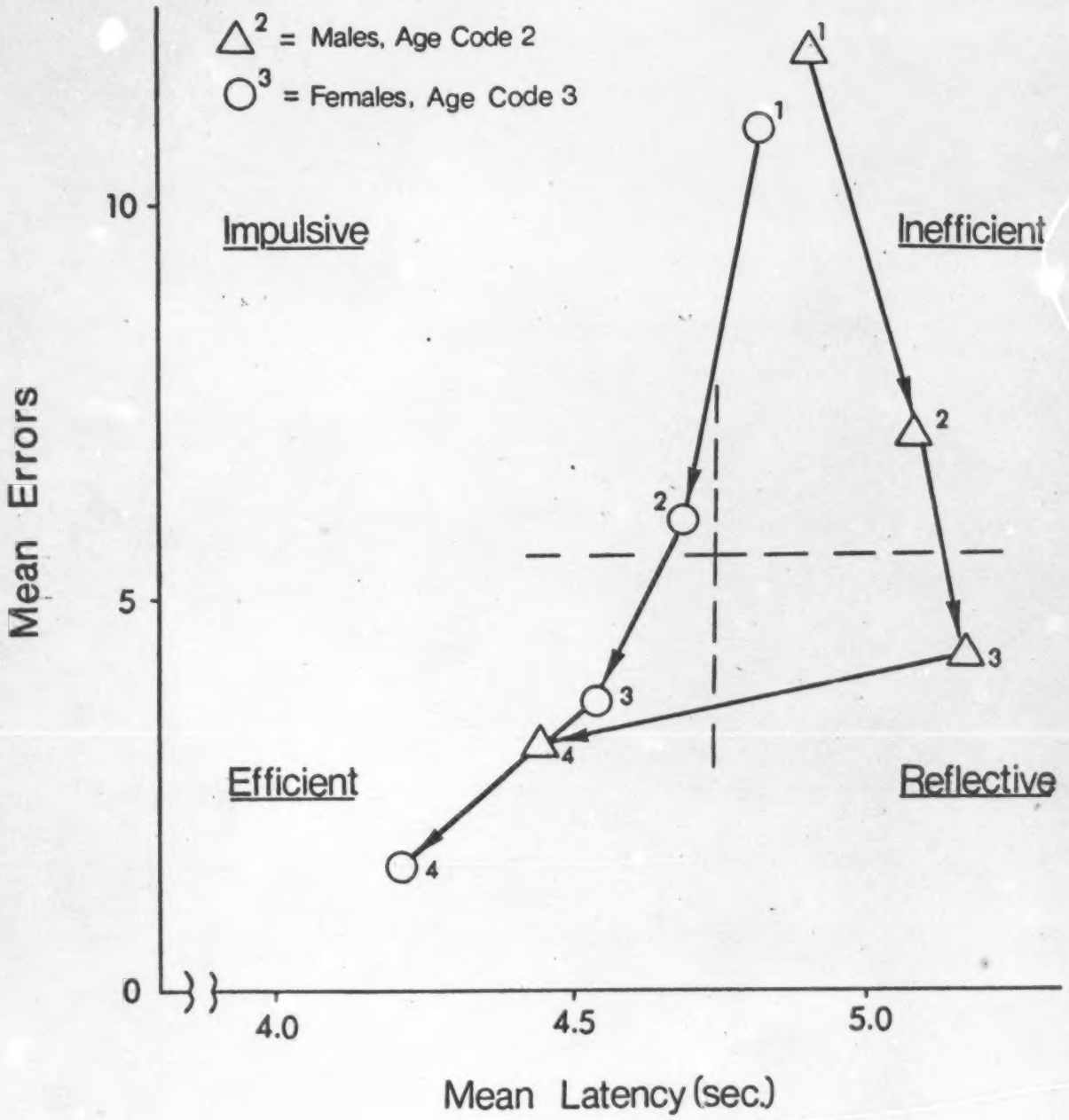

Figure 3. KRISP Performance as a Function of Age and Sex.

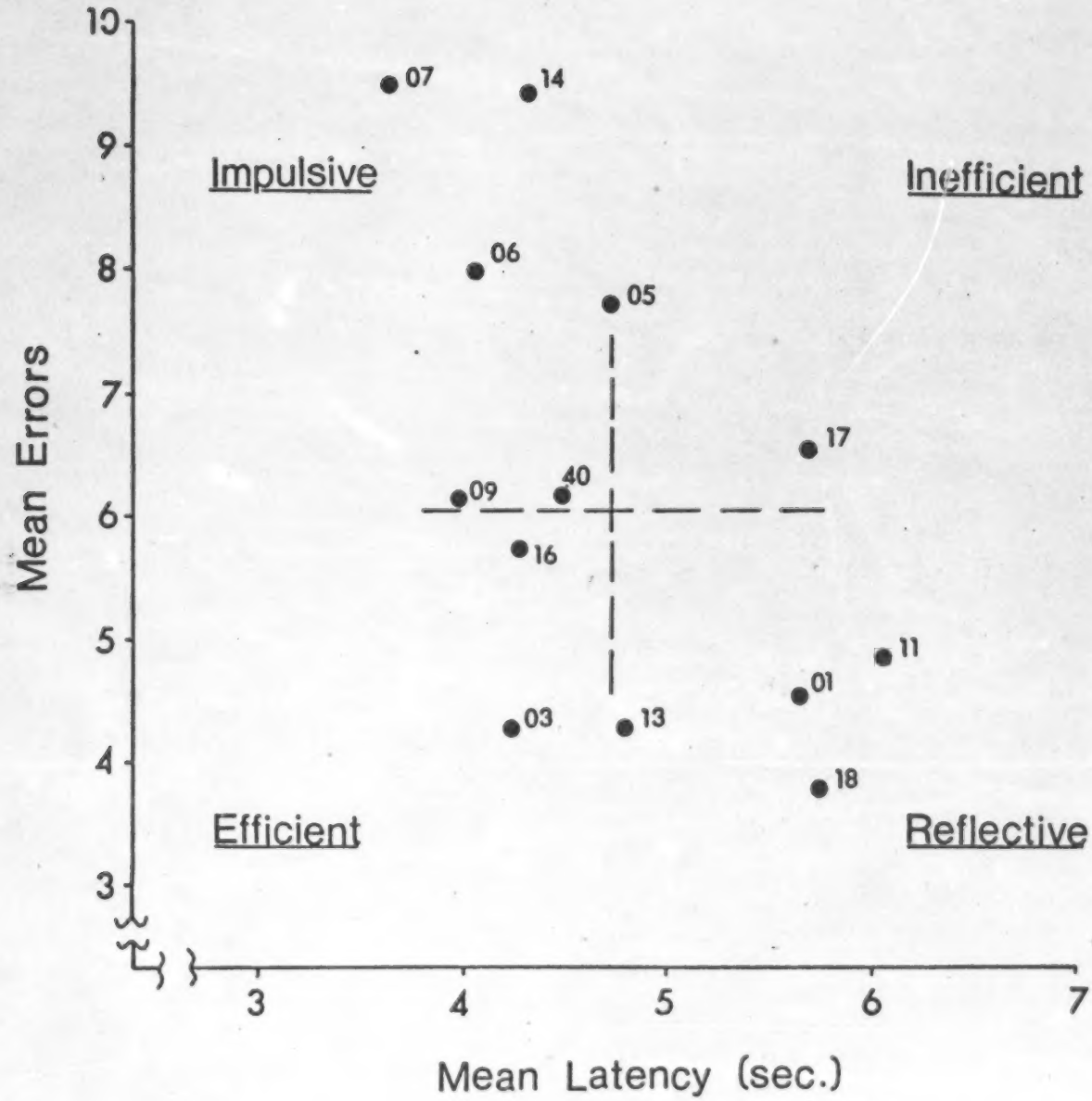

Figure 4. KRISP Performance of Contributing Samples.

Note: For identifiers, see Table 2.

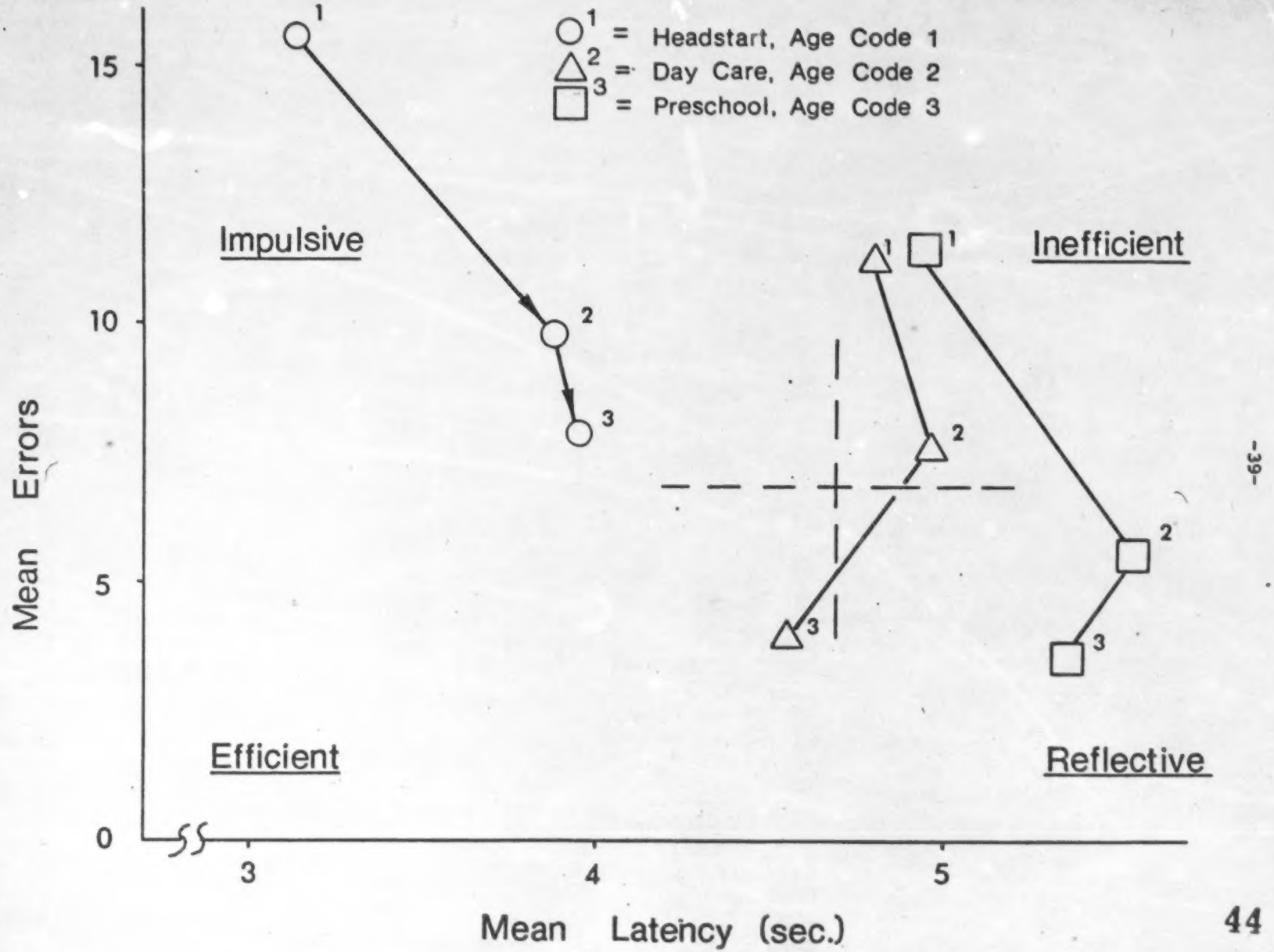

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Figure 5. KRISP Performance by Age, Sex, and Setting.

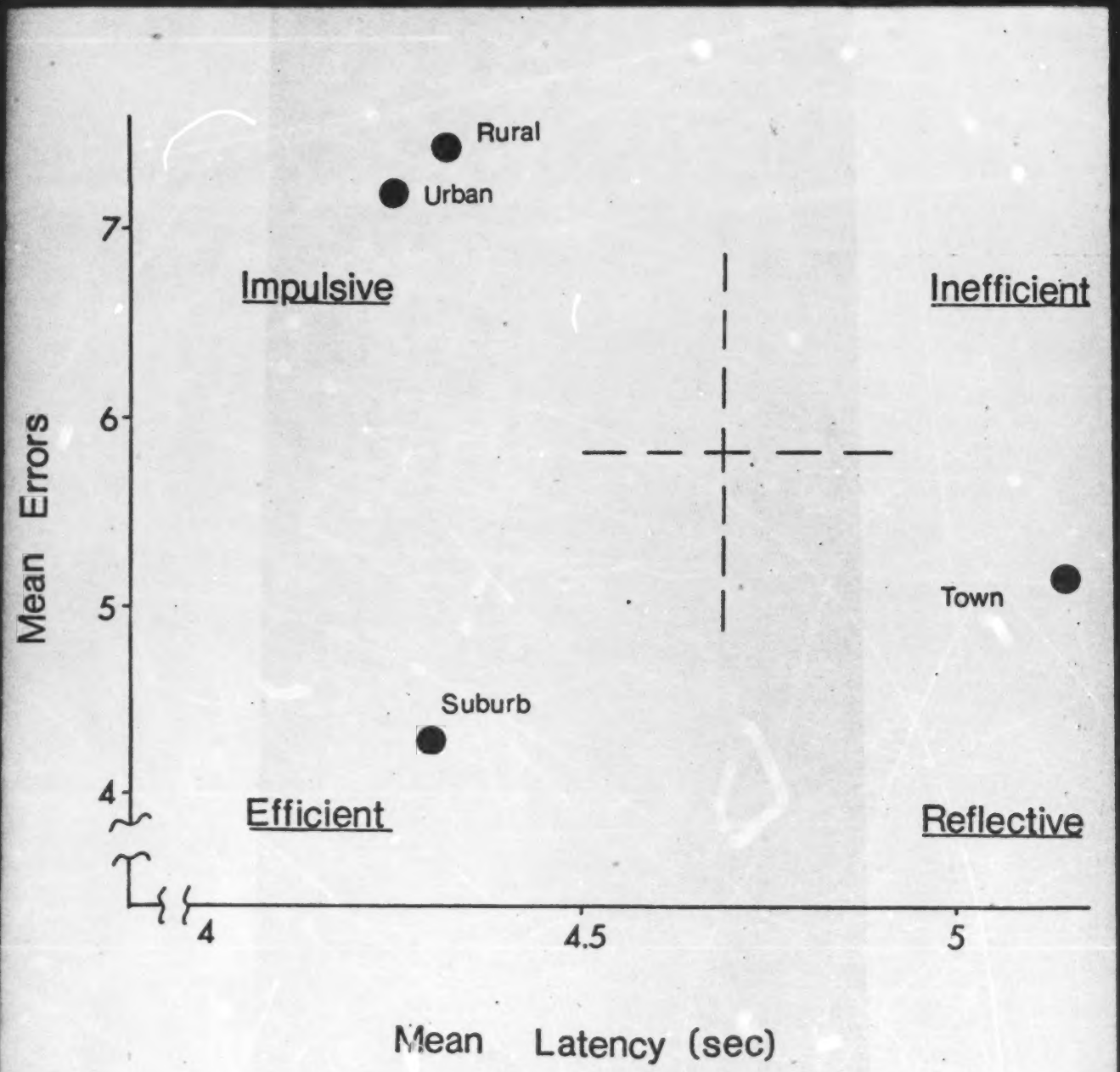

Figure 6. KRISP Performance by Community Type.

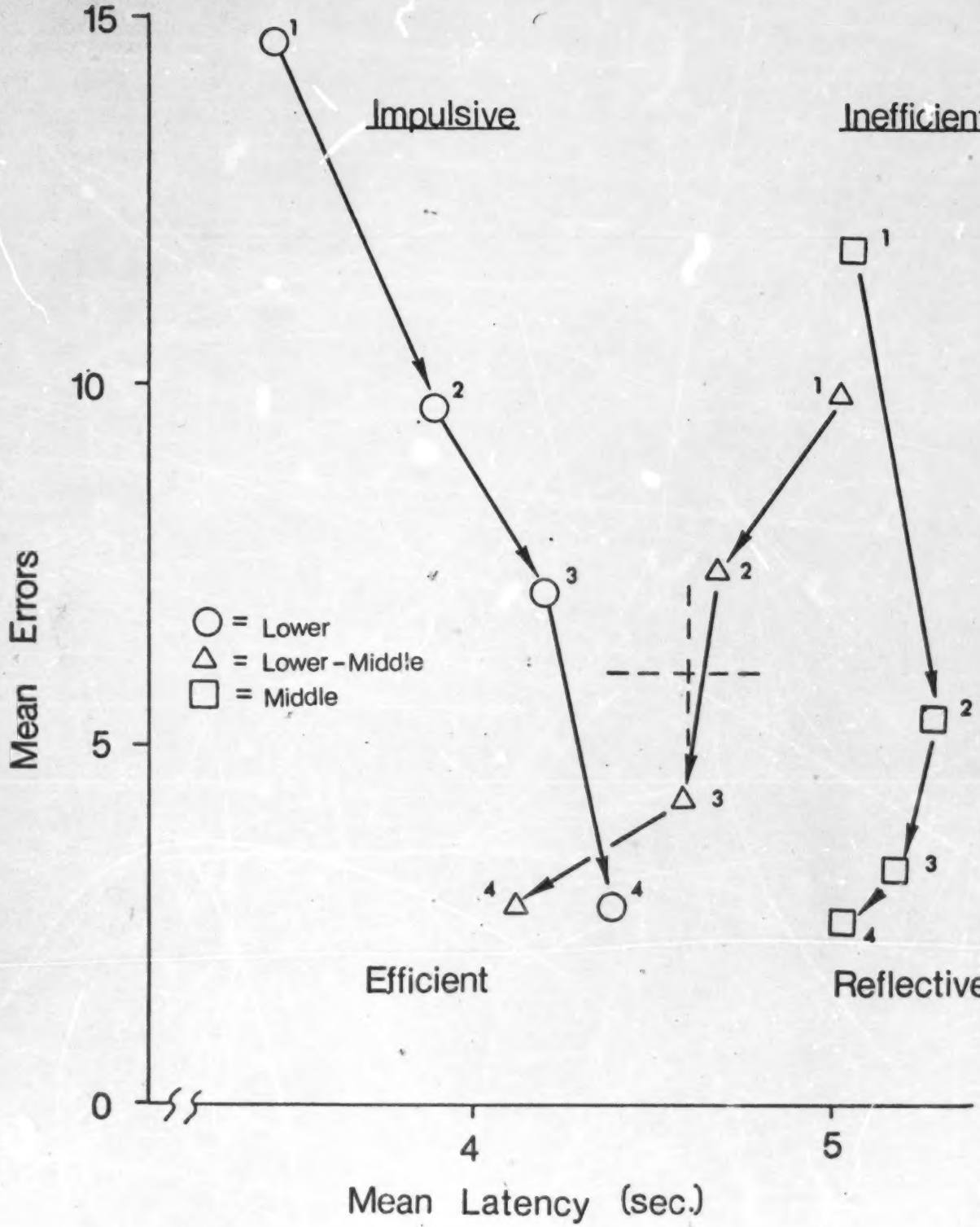

Figure 7. KRISP Performance by Age, Sex, and Estimated Income Level.

Appendix A

We would like to acknowledge the cooperation of the researchers in many different institutions who offered or contributed data to this norming project or otherwise worked with the KRISP during its initial development.

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